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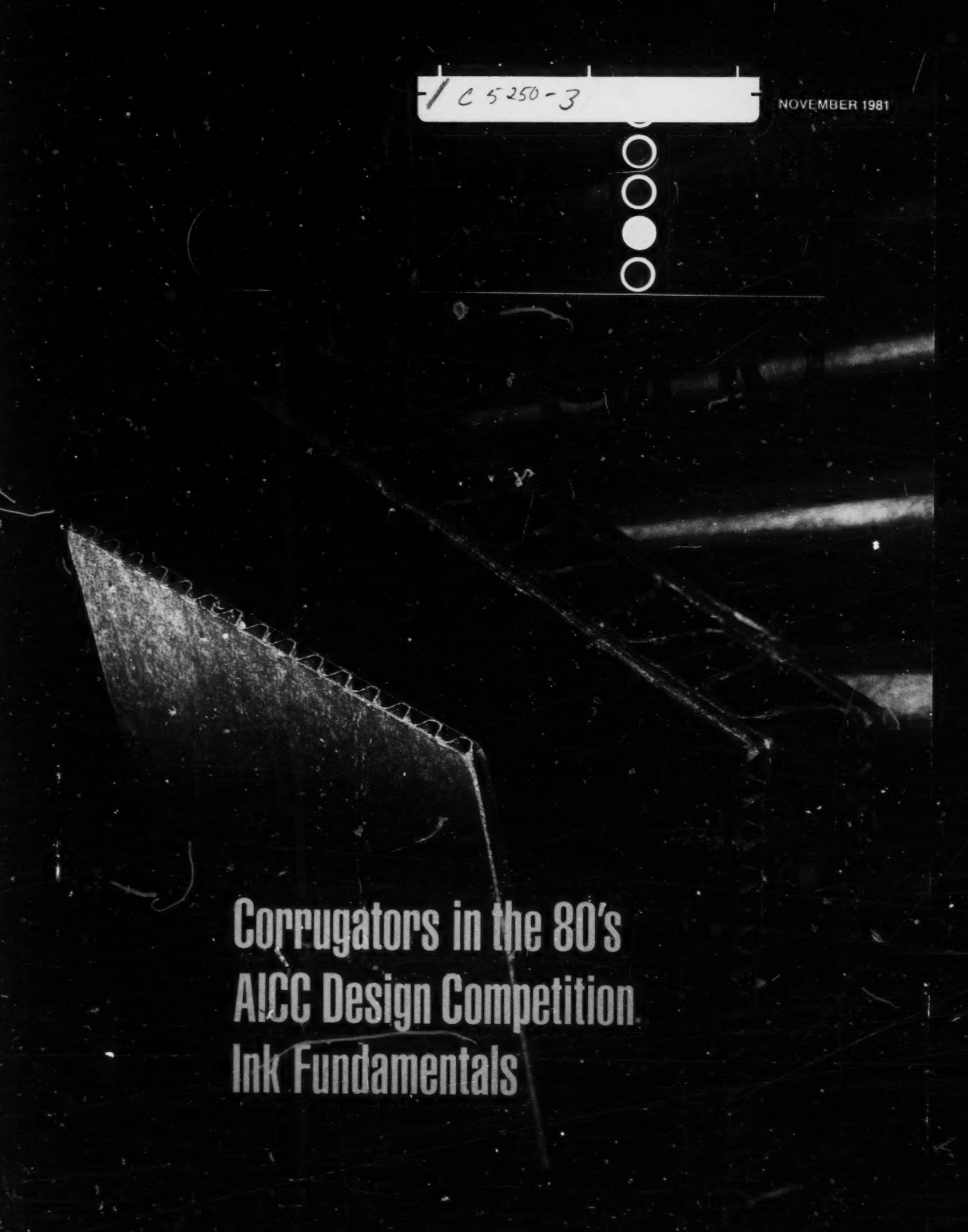

Corrugators in the 80's
AICC Design Competition
Ink Fundamentals

vol. 66 no. 11
November, 1981

on the cover

Corrugated board is the subject of this month's cover for November when both AICC and the TAPPI Corrugated Conference occur. Cover photography by Chuck Fishbein

features

PRINTING & GRAPHICS

Inking Fundamentals Can't Be Forgotten 28
Corrugated printing seminar runs the gamut from ink viscosity to general housekeeping.
by Mark Arzoumanian, Associate Editor

EQUIPMENT ENGINEERING

The Air is Not Free 34
The box converter's scrap removal system may be costing dollars as it removes heated or cooled air from the plant.
by Paul H. Reschke

Process Monitor Uncomplicates Corrugated Control 47
Mead Containers uses Air Pax's 079 to eliminate the different inherent problems in producing corrugated.

Engineering Design Allows Folder Gluer to Produce Loc Bottom & RSC Containers 118

SHOWS & AWARDS

AICC Design 81 Competition Winners 50
Keen competition is sharpened by state-of-the-art sophistication.
by Jim Young, Editor

OPERATIONS MANAGEMENT

Behind Every Symbol, There's a Code 56
by Thomas V. Sobczak

Commitment is the Key to Computer Conversion 87
Perry Packaging gets answers, expands business with computing service.

MEETINGS & CONVENTIONS

New Box Converting Equipment is Subject of Chicago Meeting 63
by Jim Young, Editor

MATERIALS ENGINEERING

A Simplified Biaxial Stress Failure Criterion for Paperboard Using Uniaxial Strength Data 93
by William S. Peterson

continued on page 8

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← Circle no. 203 for information on Bobst ad

features continued

MATERIALS ENGINEERING

Something New is Cooking in Corrugated 102
Paperboard replaces sheet aluminum in this cost effective and convenient solar oven.
by Ruth Weber, Assistant Editor

Bulk Handling System Solves Shipping Problems 114
According to USI, this new shipping system from Tri-Wall Containers is an economical and efficient method of loose bulk shipping.

STATE OF ART REPORT

Development of Corrugators in the 80s 70
A forecast of the development of corrugator machine design in the decade of the eighties as taken from a presentation before the First FEFCO Technical Seminar, Milan, Italy.
by Dipl.-Ing (FH) Edward Bradatsch

PACKAGE ENGINEERING

The Principle of Load Sharing in Corrugated Fiberboard 122
by Thomas J. Urbanik

SHOWS & EXHIBITIONS

Optimism Pervades Graph Expo '81 136

departments

10	Comment	155	New Products & Equipment
14	Newsletter	157	People
18	News	159	New Literature
40	Industry Statistics	161	Industry Events
144	Short Runs	163	Classified Advertising
150	International Events	167	Advertisers' Index
150	International Dateline	168	Publisher's Report on Suppliers
150B*	World News Briefs		
154	Product of the Month		

*International Edition

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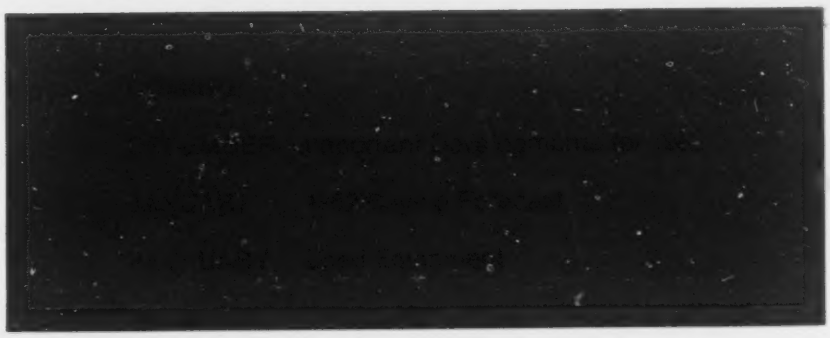

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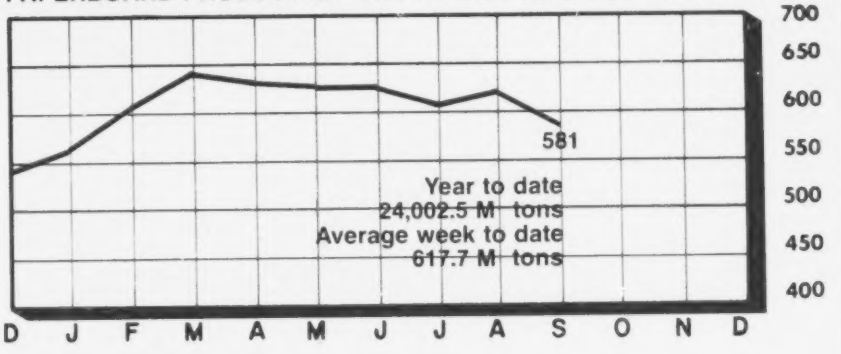
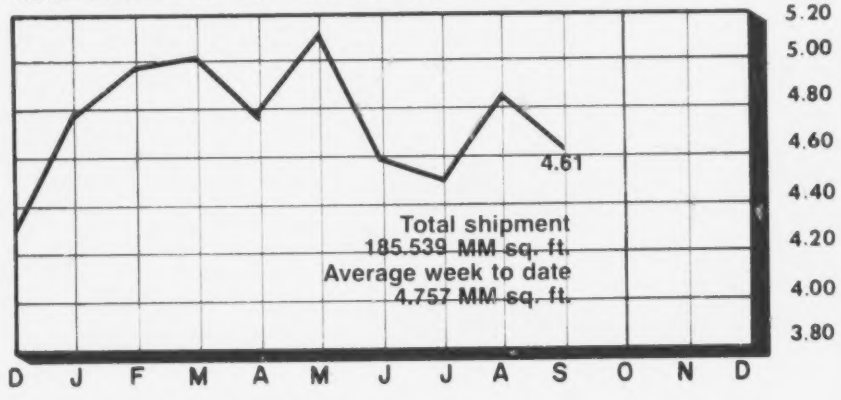
INDUSTRY STATISTICS

PAPERBOARD PRODUCTION 1981-WEEKLY AVERAGE 1,000 Tons



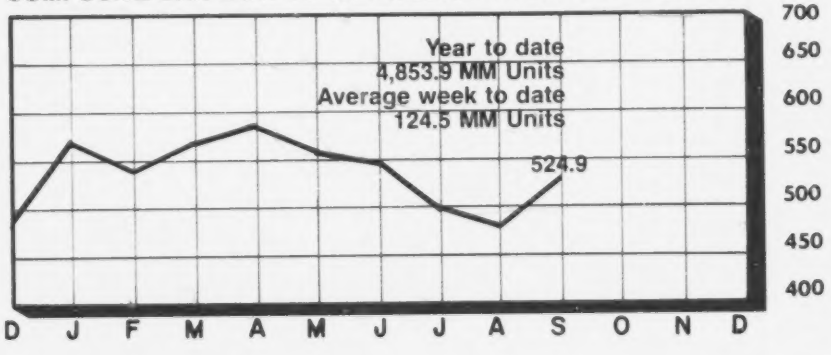
PAPERBOARD MILL OPERATIONS: The first three quarters of 1981 concluded with average-week board output 3.8% above same-period 1980 tonnage, compared with a 1% drop in '80 from '79 and a 3.3% rise in '79 from '78. However, the third quarter itself produced a 5.4% rise, with an increase of 6% in unbleached kraft furnishes, 5% in semichemical, 2.3% in bleached, and 6.6% in recycled. The year-to-date margin of 4.5% in unbleached kraft volume reveals a significant reduction in linerboard export, since fibre box shipments were 4% up from last year at end of the quarter.

FIBRE BOX SHIPMENTS 1981-WEEKLY AVERAGE Billion Sq. Ft.



PAPERBOARD-TYPE PRODUCTION: In September, 2491.2 M total tons of output — down 1.4% from '79 — appeared as 1845.3 M of containerboard grades — down 1.9% — and 645.9 M of boxboards — up 1% — according to projections from the American Paper Institute's "production by furnish" data. This ratio of tonnage, now nearing 3-to-1, compares unfavorably with the traditional 2-to-1 in more normal economic times. It appears to substantiate informal reports of double-digit recent-months drops in volume of packagings made from boxboard grades, but no longer reported publicly by compilers.

COMPOSITE CAN OUTPUT 1981-WEEKLY AVERAGE Million Units



RIGID PAPER BOXES: Three quarters of the way through 1981, major set-up box-makers report a rise of some 10% in total billings from 1980, compared with 6% in '80 over '79 and 8.7% in '79 over '78. For a longer-term comparison — this September's billings were up 27% from the 1976 month, and 57% from '71. Geography and economics continue their toehold. Three years ago, the Midwest and Pacific Coast regions were respectively 21% and 30% above the previous year's level, while the eastern Empire area was up only 5% and New England was 4% down. Currently, with the cyclic change in fortunes, those figures are about to be reversed. □

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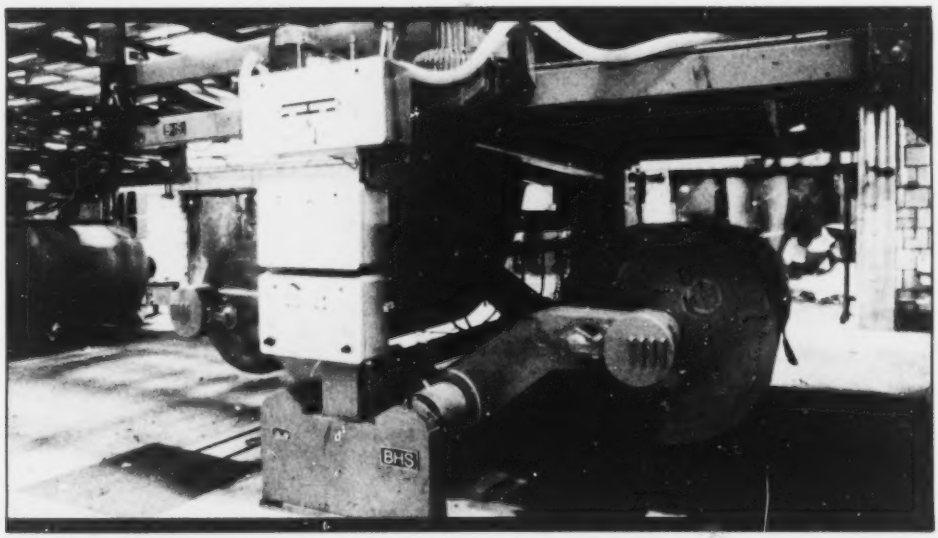
paper board packaging STATE OF THE ART REPORT



BHS high performance splicer with mill roll stand

Development of Corrugators in the 80s

by Dipl.-Ing. (FH) Edward Bradatsch,
BHS-Werk Weiherhammer

A forecast of the development of corrugator machine design in the decade of the eighties as taken from a presentation before the First FEFCO Technical Seminar, Milan, Italy.

This presentation is printed here with the permission of the author, BHS-Werk Weiherhammer, and FEFCO.

In order to give an accurate description of corrugators in the '80s, it would be useful to analyze the corrugated board industry in the '70s. We shall attempt this by means of statistics for the corrugated board industry in the Federal Republic of Germany, which ought to be representative of the majority of industrialized countries in Western Europe too.

Consumption trends

The '70s saw an average increase of 120 million m² per annum, although the first oil crisis of 1975/76 and the decreased consumption related thereto resulted in a drop in production of approximately 10%.

As far as the '80s are concerned, the general overall economic situation indicates little or no growth. The corrugated trade can, however, anticipate an average rise of 1.5-2.0% (i.e. with approximately 60-70 million m² per annum), since partially lost markets (synthetic packaging) can be won back by reason of cost advantages and/or new markets opened as a result of product innovation.

In 1980, in the Federal Republic of Germany, approximately 3.7 billion gross m² of corrugated board were produced in about 48,000 shifts. Capacity of all plants stood at about 85-90%. It is important to note with regard to this latter figure that many facilities have still not attained sufficient modernization and hence full productivity because of environmental considerations.

Cost/price trends

On the basis of the cost analysis for a corrugated board company with high output, as illustrated in Table 2, attention should be paid to the following substantial costs and trends: the cost of raw materials, wages, energy, transport and capital costs.

The cost of raw materials and auxiliary materials account for the lion's share of all costs, i.e. approximately 55-60%.

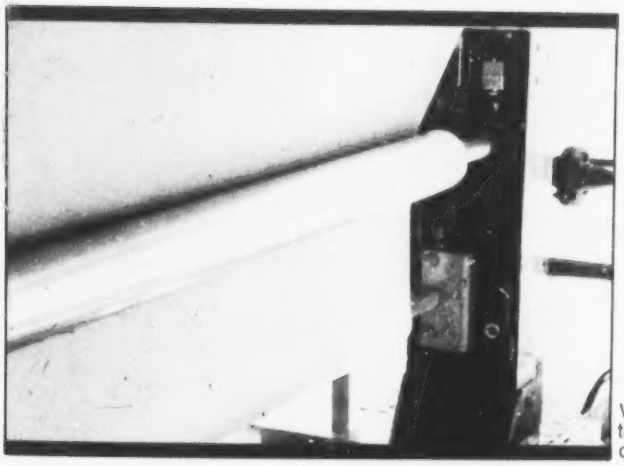
The development of paper prices is heavily dependent on the export of paper from the USA to Western Europe. Furthermore, the marked energy cost proportion per ton in paper production is reflected in the price of paper.

Approximately two thirds of paper use in West Germany is made from reprocessed waste paper. Undoubtedly a company capable of rational manufacture of its own paper is not completely subject to the considerable price fluctuations associated with externally produced or imported paper.

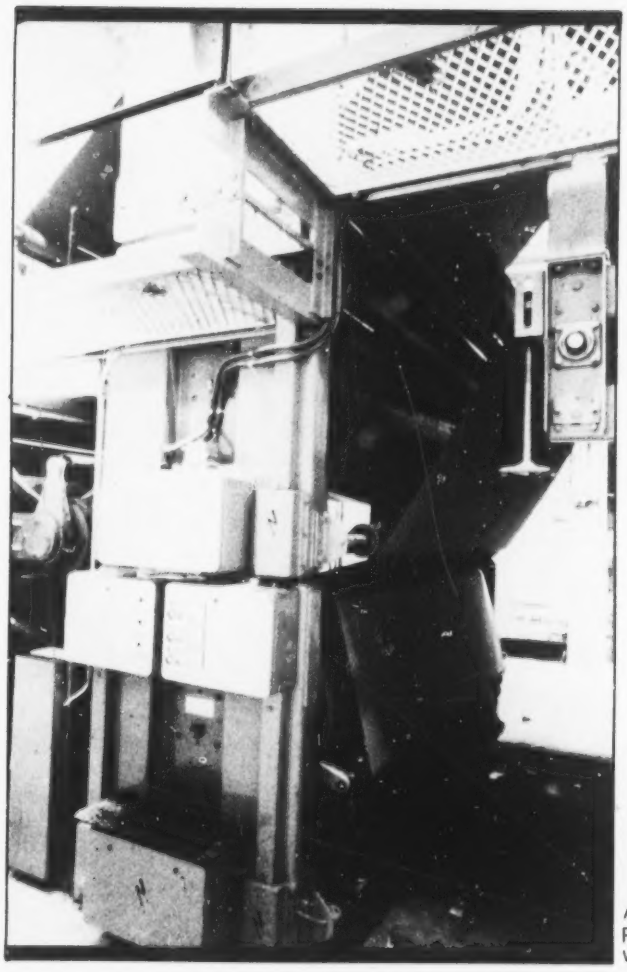
Wages per man and year almost doubled in the '70s. In fact, in terms of increase, they exceeded the rise in productivity. A further increase is anticipated in the years to come, albeit not on the same level.

Energy costs also doubled in the '70s, particularly oil prices, and the first half of the present decade should see the price of oil doubling yet again.

Electricity costs will not be subject to such a drastic increase, although, in accordance with present trends, we can ex-



Web tension control



Automatic Pre-heater wrapping

pect a not inconsiderable rise. As energy costs account for only about 2% of the net turnover, the effects of the price rise out of proportion should not be underestimated.

If we look at the development of transport costs, which constitute approximately 5% of net turnover, we are surprised to find that these have remained practically constant throughout the '70s, thanks to the effects of rationalization. However, forecasts suggest that we must expect rising transport costs because of the drastic increase in the cost of fuel.

Capital costs (interest for operating capital and depreciation) equalled over 6% of net turnover, in accordance with Table 2. Investment costs will also be subject to an upward trend, as necessary rationalization investment (still to be discussed) have to continue into the '80s, because of the competition with other packaging products.

The investment costs for a corrugator meeting current technical specifications are approximately DM 7-8 millions as opposed to approximately DM 2.5-3.0 millions 10 years ago. With reference to the m^2 output, and taking the West German rate of inflation of 4-5% per year into account, the investment costs for corrugators per m^2 produced have remained the same or even dropped somewhat, as a new corrugator is capable of approximately twice the output as at the beginning of the '70s.

As has already been pointed out at the FEFCO Conference in Athens, the price per ton of corrugated board (price-adjusted for inflation) has not changed over the last 15 years. This trend will probably continue in the future, because of the prevailing demand and capacity situation.

The above analysis shows that the expected higher than average inflation cost increases can only be absorbed by means of rationalization measures, i.e. an increase in productivity.

Productivity in the German corrugated board industry rose in accordance with the rationalization measures implemented in the '70s, from approximately 100 m^2 per man-hour to approximately 170 m^2 per man-hour; in fact, largely as a result of extensive innovation in the engineering industry.

The continued reduction of production costs will be one of the chief tasks of the entrepreneur in the '80s.

Mechanical innovations of the late '70s and the '80s must meet this requirement.

Engineering developments

The '70s can be justifiably termed the decade of innovation in the corrugated board industry. In accordance with marked demands, BHS developed the following automation units which were fitted, to a large extent, in existing and new corrugators (See Table 3).

Production data for a new, fully automated corrugator compared with those for a conventional corrugator (Table 4, conventional; Table 5, fully automated).

A modern corrugator, installed in 1980/81, can, as practice has shown, attain the production figures specified in Table 5, i.e. in the case of two-shift operation, a gross output of between 70

Corrugators in the 80s

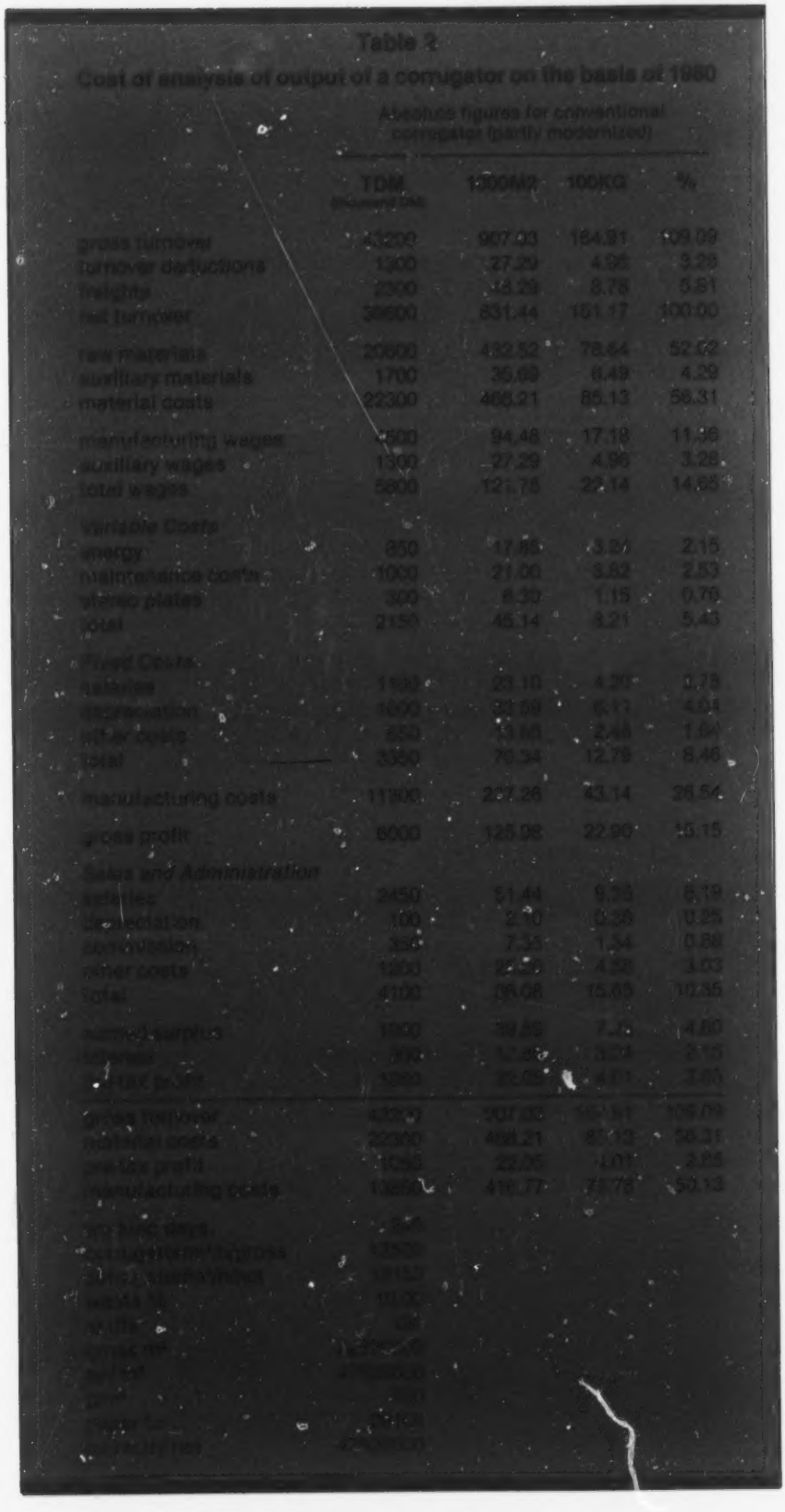


Table 2

Cost of analysis of output of a corrugator on the basis of 1980

Absolute figures for conventional corrugator (partly modernized)

	TDM (thousand DM)	1,000 M²	100 KG	%
gross turnover	33200	907.03	164.91	109.09
turnover deductions	1300	27.29	4.96	3.28
freights	2900	48.29	8.78	5.81
net turnover	38600	831.44	151.17	100.00
raw materials	20600	432.52	78.64	52.02
auxiliary materials	1700	35.69	6.49	4.29
material costs	22300	468.21	85.13	56.31
manufacturing wages	4500	94.46	17.18	11.36
auxiliary wages	1300	27.29	4.96	3.28
total wages	5800	121.75	22.14	14.65
Variable Costs				
energy	850	17.85	3.24	2.15
maintenance costs	1000	21.00	3.82	2.53
stereo plates	300	6.30	1.15	0.76
total	2150	45.14	8.21	5.43
Fixed Costs				
salaries	1150	23.10	4.20	2.78
depreciation	1600	33.59	6.11	4.04
other costs	650	13.65	2.48	1.64
total	3350	70.34	12.79	8.46
manufacturing costs	11800	297.26	43.14	26.54
gross profit	6000	125.98	22.90	15.15
Sales and Administration				
salaries	2450	51.44	9.36	6.19
depreciation	100	2.10	0.38	0.25
commission	350	7.35	1.34	0.88
other costs	1200	25.20	4.58	3.03
total	4100	86.08	15.65	10.35
earned surplus	1900	39.90	7.25	4.80
interest	800	16.80	3.05	2.02
tax on profit	1200	25.20	4.58	3.03
gross turnover	43200	907.03	164.91	109.09
material costs	22300	468.21	85.13	56.31
gross profit	1000	22.05	4.01	2.64
manufacturing costs	13800	416.77	75.78	50.13
no. of man days	240			
corrugators/24 hours	13500			
m²/man/shift	18750			
waste %	10.00			
profit	6%			
output	1,250,000			
costs	1,000,000			
profit	250,000			
cost/m²	0.80			
profit/m²	0.20			
cost/100 kg	75.78			
profit/100 kg	18.97			

and 75 million m² and/or a net output of 65-70 million m² with manpower of only 5 men per shift and a waste level of approximately only 5% including reel stripping and side trim waste.

Results

After comparing these results with the data of a conventional corrugator (see also Table 4/5) the following advantages emerge:

- waste savings—approximately 3%
- manning reduction—approximately 5 men/shift
- reduction in volume of steam—approximately 1 ton/hour
- increase in output—approximately 60-70%.

The developments of the late '70s, such as the fingerless single facers (with production speeds of up to 250 m/min.), the new sheet size change process for continuous running operation, the high-speed cut-off unit and the take-off unit (for running speeds up to 250 m/min.), together with the possible use of data stores and microprocessors, will not come fully into their own until the first half of the '80s. Nonetheless, there are still other developments in the offing which, logically, will serve to improve quality and reduce costs, as well as further product innovation, rather than increase conventional capacity.

Single-facer

Since 1978/79 BHS has been making practical use of its fingerless single facer.

The simple principle of working with heated, cost-effective corrugating rolls, enables a method of operation with optional paper working width (between 1.3 - 2.45/2.6 m) with production speeds of up to 250 m/min. An analysis of the end product gave outstanding values as far as high/low is concerned.

Because of the precise flute heights first-rate rigidity values were attained.

The use of fingerless single facers enables higher average speeds to be reached, while better rigidity values can result in either the use of lower g.s.m. paper or cheaper substitute papers (different fibre composition).

Adhesive application

Improvements already made to conventional adhesive application systems, such as enlarging the roller diameter with more precise mounting and the correct speed ratio between adhesive applicator roll and doctor roll, respectively, between adhesive applicator roll and medium (single faced web) has led to greater constancy of application, despite the use of adhesives with higher starch

Corrugators in the 80s

solids contents. The '80s should see the further development of adhesive application systems, which should also be capable of keeping a precise check on the given quantity applied according to quality, despite varying volumes of inflow, i.e. adhesive application systems with application volume control.

With the new BHS adhesive applicator we can expect savings in terms of the volume of adhesive applied of, on average, 1.5 - 2 g/m² over the conventional systems (i.e. for example volume C-flute BHS fingerless single facer EWR-VT 3,5 g/m², double backer glue unit 4 g/m², 28% solids).

Heating section with BHS Chaintrol system

Table 3

BHS Development of the '70s

Item	Description	Year conceived	No. of fitted machines
1.	Automatic splicer. Automatic up to 150/200 m/min	1972/79	ca. 300
2.	Automatic web tension control	1975	ca. 100
3.	Fingerless Single Facer (BHS vacuum tube system) up to 250 m/min	1978/79	ca. 35
4.	Automatic pre-heater/preconditioner - wrapping	1975	ca. 160
5.	Automatic bridge store control	1975	ca. 50
6.	Improved adhesive applicator with motorized glue line adjustment	1975	ca. 100
7.	Heating section with Chaintrol system	1973	ca. 50
8.	Sheet size change for continuous operation with one or two automatic slitter/scorers	1970-80	ca. 60
9.	Direct drive cut-off units—up to 200/250 m/min	1977-80	(120) motors
10.	Automatic stacker unit with side-chamber arrangement—up to 250 m/min	1978	9
11.	Central Control panel	1975	ca. 30
12.	Deckling/marry-up program	1978	ca. 9
13.	Order change-data store/processor	1979	ca. 10
14.	Quality change-data store/processor with data-printer	1979	

Corrugator energy

New adhesives, even with approximately 30% solids, are characterized by lower viscosity and lower "Gel" points (approximately 45-50°C). They can be used throughout the corrugator, thanks to the fingerless single facer, and reduce the heating energy requirements in the setting of the adhesive film, i.e. the temperature, particularly that of the heating section, can be dropped despite maximum running speeds.

In the case of the double wall process,the use of the so-called Jet-Assistant-Steam-System is additionally helpful and also permits maximum production speeds.

The use of a modern steam system also helps to bring down heating requirements. A steam consumption reading on the single facer also shows how almost half of the heating energy is required to heat the machine itself, while the other half is needed for heat release on the paper webs.

When combined with sound insulation chambers, the heat exhaust in the case of single facers can be turned to good use (e.g. via heat exchangers).

The same applies to the heating section. Modern, fixed-tension hot-plates also permit the insulation of the underside of hot-plates.

All the measures specified above can lead to a considerable reduction in the volume of heat required or higher output with the same consumption.

Cold bonding

It is common knowledge that the Institute of Paper Chemistry in the USA is particularly concerned with the development of a cold bonding process. This would constitute an enormous step forward for the corrugated board manufacturing process, especially as far as the quality of corrugated board (flat sheets) and energy saving are concerned. BHS equipment could be rapidly converted to any cost effective development such as the cold setting process.

Improved operation

Apart from the centralized operation/control which has already been put into practice, the following measures would be desirable:

- automatic feeding of the rolls of paper;
- motorized roll carriage;

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Corrugators in the 80s

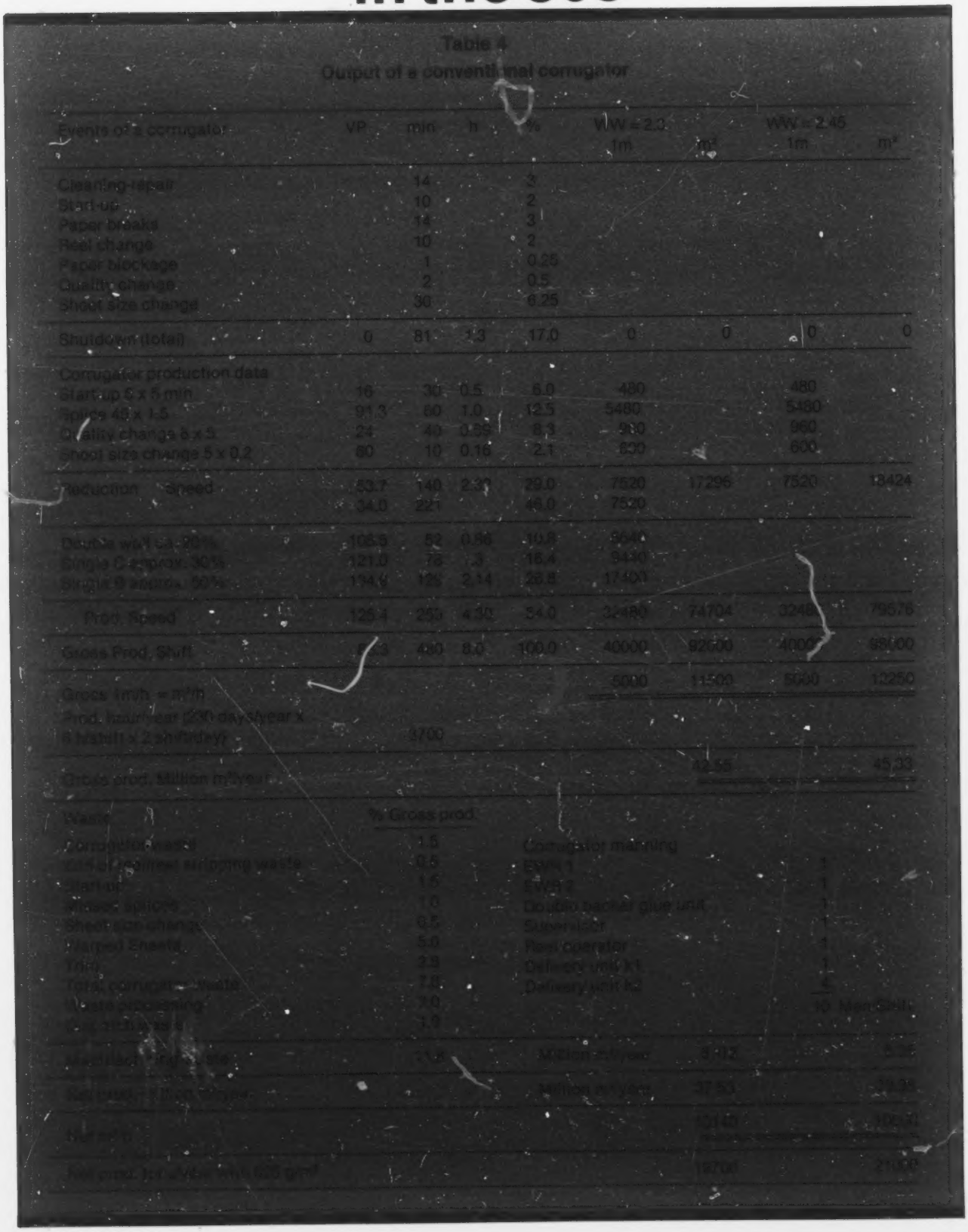


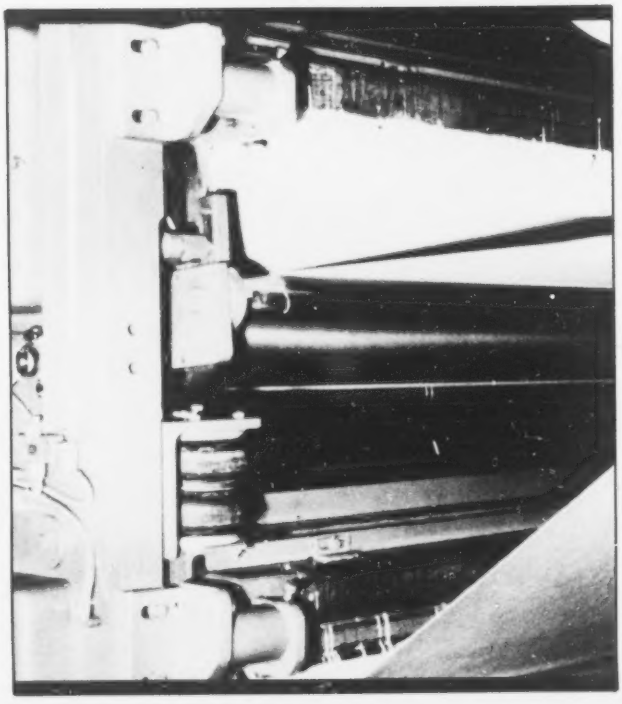
Table 4

Output of a conventional corrugator

Events of a corrugator	VP	min	h	%	WW = 2.3 lm	WW = 2.3 m²	WW = 2.45 lm	WW = 2.45 m²
Cleaning-repair		14		3				
Start-up		10		2				
Paper breaks		14		3				
Reel change		10		2				
Paper blockage		1		0.25				
Quality change		2		0.5				
Sheet size change		30		6.25				
Shutdown (total)	0	81	1.3	17.0	0	0	0	0
Corrugator production data								
Start-up 5 x 5 min	16	30	0.5	6.0	480		480	
Splices 49 x 1.5	91.3	60	1.0	12.5	5480		5480	
Quality change 8 x 5	24	40	0.66	8.3	960		960	
Sheet size change 5 x 0.2	60	10	0.16	2.1	600		600	
Reduction speed	53.7	140	2.30	29.0	7520	17296	7520	18424
	34.0	221		46.0	7520			
Double wall CA 90%	108.9	52	0.86	10.8	5640			
Single C approx. 30%	121.0	78	1.3	16.4	9430			
Single B approx. 50%	194.4	126	2.14	26.8	17400			
Prod. Speed	125.4	253	4.30	54.0	32480	74704	32480	79576
Gross Prod. Stuff	166.3	480	8.0	100.0	40000	92000	40000	98000
Gross t/m/h. = m/m					5000	11500	5000	12250
Prod. hours/year (300 day/year x 6 hours/d x 2 shifts/day)		3700						
Gross prod. Million m²/year						42.55		45.33
Waste	% Gross prod.							
Corrugator waste	1.5				Corrugator manning			
Cut & sheet stripping waste	0.6				EWS 1	1		
Start-up	1.5				EWS 2	1		
Missed splices	1.0				Double backer glue unit	1		
Sheet size change	0.5				Supervisor	1		
Warped sheets	5.0				Reel operator	1		
Trim	2.9				Delivery unit 1	1		
Total corrugator waste	7.0				Delivery unit 2	1		
Waste processing	2.0					7		
Core, rejects etc.	1.0					10 Men Shift		
Machine efficiency	13.6				Million m²/year	3.42		5.32
Saleable million m²/year					Million m²/year	37.53		39.98
Reel width						42140		42140
Reel prod. (on a 600 mm reel)						19700		21000

Circle no. 229 for information on Gandossi & Fossati ad

Corrugators in the 80s



Duplex adhesive applicator

- automatic paper feeding device in conjunction with a new bridge system with proper web tension control of single-face webs;
- motorized width adjustments;
- motorized glue line adjustment.

When contemplating installing any of the above auxiliary equipment, always bear in mind the payback potential.

EDP and microprocessors

Electronic calculating and control systems are sensible, efficient, tried and tested and are particularly suitable for automated sheet size and quality change sectors. Future development in the area of production control is also possible.

Pre-printing liner

The pre-printing of backer liners, in-line or alternatively as a separate precorrugating operation, is already in use. It offers the following advantages:

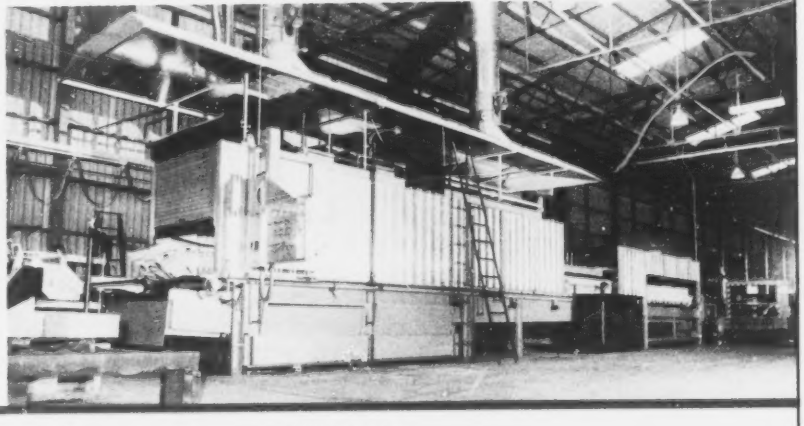
- maintaining corrugated board rigidity values by avoiding the need for a separate printing operation
- improved printing, covering a wider surface.

As far as the corrugator itself is concerned, preprinted liners require the following additional units:

ANDAX
ENGINEERS

for waxing corrugated

ANDAX WAX IMPREGNATING MACHINE TYPE HYB/R
MODULAR CONSTRUCTION (U.S. Patent 4,085,701)



OTHER STANDARD ANDAX WAX IMPREGNATING MACHINES AVAILABLE

— MINI WAXER
— TYPE JU

UNITED STATES OF AMERICA:
Andax Engineers Inc.,
P.O. Box 187,
NEWARK, Ca. 94560, U.S.A.
Works: 38424 Cedar Blvd., Newark, California
Telex: 337779
Telephone: (415) 794-6100

AUSTRALIA:
Andax Pty. Limited,
P.O. Box 41,
CLAYTON, Vic. 3168, Australia.
Works: Chr. Gardiner & Commercial Rds.,
North Clayton, Victoria.
Telex: 30010
Telephone: (03) 544-5911

Circle no. 238 or Reader Service card

Circle no. 231 for information on Consolidated Engravers ad →

Corrugators in the 80s

Control panel

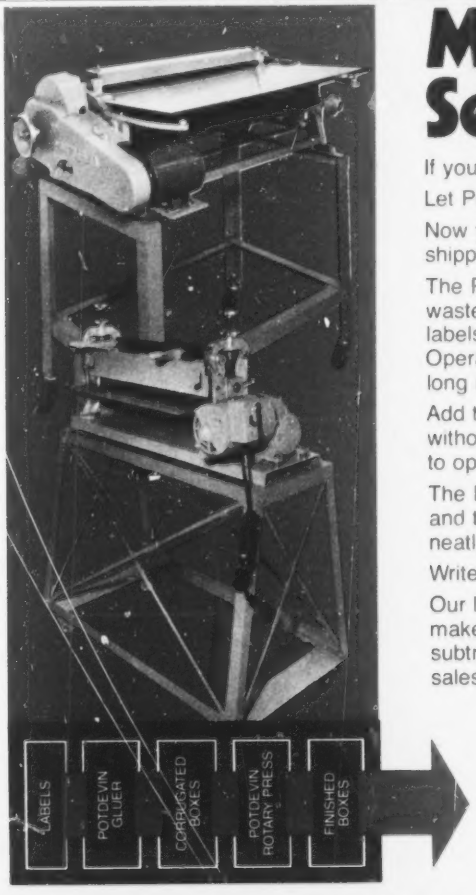
- web edge controls for all the individual paper webs
- better belt controls
- accurate controls for the automatic slitter/score according to the longitudinal adjustment mark
- electronic facilities for the direct drive cut-off unit for adjusting the knife to the pre-printed mark.

Trends of the '80s

Raw material savings. The approximately 3% saving in waste yields a cost savings of approximately DM 750000 per year for a 2-shift operation (see Table 4/5).

Labor savings. A fully automated corrugator can be operated by 5 men/shift (see Table 4/5). In the case of a 2-shift operation this means a saving of approximately 10 men over the conventional unit, i.e. DM 500,000 per year in German labor costs.

Energy savings. Modern steam systems, new heating sections and improved blanket belts, high adhesive solids concentration, new adhesives, heat insulation and/or exploitation of exhaust head in the case of a single-facer can all involve a reduction in steam consumption of approximately 1-1.5 t/h. In



Make Shipping Boxes Selling Boxes

If your product's great, the box should say so.

Let Potdevin help.

Now you can apply eye-catching color labels to cardboard shipping containers with just two simple units.

The Potdevin Gluers apply a uniform coating of glue, without waste or mess . . . requires no changeover time for different size labels or boxes . . . handles labels up to 53" wide by any length. Operated with unskilled operators. Economical for both short and long runs.

Add the Potdevin Rotary Press for smoothly laminating labels without air bubbles or wrinkles. Ruggedly constructed and easy to operate, the Rotary Press does the job flawlessly and quickly.

The Potdevin Gluers . . for neatly glued labels and the Rotary Press . . . for high speed, neatly laminated labels.

Write for literature.

Our low cost Potdevin team for box makers and box users adds color, subtracts problems and multiplies sales appeal.

ESTABLISHED IN 1881 POTDEVIN

Potdevin Machine Co.

359 North Street, Teterboro, New Jersey 07608

Circle no. 232 on Reader Service card

Corrugators in the 80s

(continued from page 82)

Table 5

Output of a fully automated corrugator with fingerless single facers

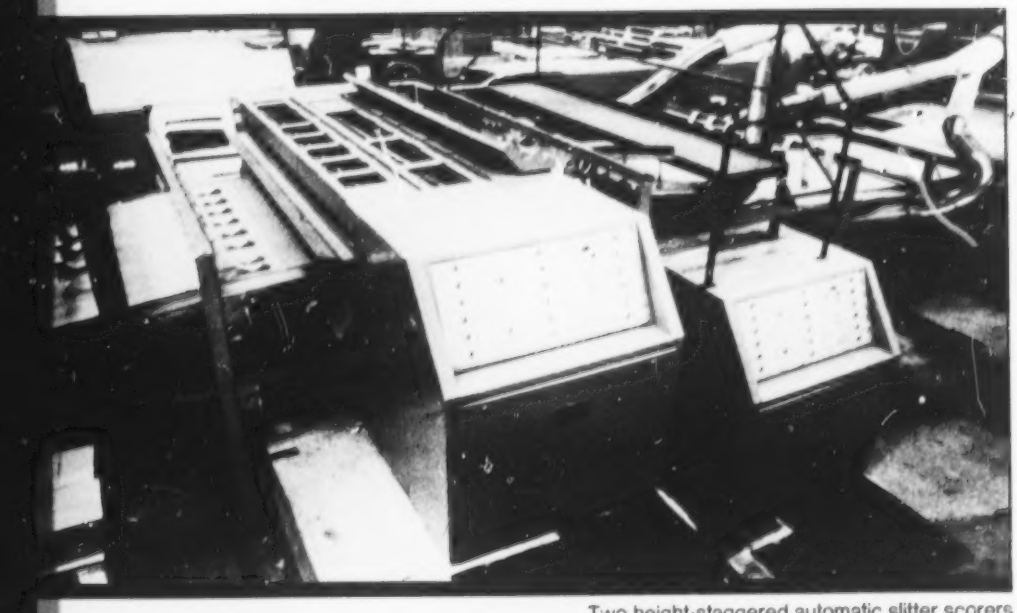
Events of a corrugator	VP	min	h	%	WW = 2.3 1m	WW = 2.3 m²	WW = 2.45 1m	WW = 2.45 m²
Cleaning-repair		14		3				
Start-up		10		2				
Paper breaks		14		3				
Reel change		2.5		0.5				
Paper blockage		5		1				
Quality change		2.5		0.5				
Sheet size change		5		1				
Shutdown (total)	0	53	0.88	11.0	0	0	0	0
Corrugator production data								
Start-up 6 x 5 min.	25	30	0.5	6.0	750		750	
Splice 45 x 1.5	150	60	1.0	12.6	9000		9000	
Quality change 8 x 5	40	40	0.66	8.3	1600		1600	
Sheet size change 5 x 0.2	100	10	0.16	2.1	1000		1000	
Reduction Speed	88.2	140	2.32	29.0	12350	28405	12350	30258
	63.0	193		40.0	12350			
Double wall ca. 20%	160	58	0.96	12.0	9120		9120	
Single C approx. 30%	180	86	1.43	18.0	15390		15390	
Single B approx. 50%	200	143	2.38	30.0	28500		28500	
Prod. Speed	184.7	287	4.80	60.0	53010	121923	53010	129874
Gross Prod. Shift	136	480	8.0	100.0	65360	150328	65360	160132
Gross 1m/h = m²/h					8170	18800	8170	20000
Prod. hour/year (230 days/year x 8 h/shift x 2 shift/day)		3700						
Gross prod. Million m²/year						69.56		74.0

Waste	% Gross prod.
Corrugator waste	1.4
End of reel/reel stripping waste	0.2
Start-up	0.2
Missed splices	0.2
Sheet size change	0.5
Warped Sheets	2.5
Trim	2.5
Total corrugator waste	5.0
Waste processing	1.0
Dispatch waste	1.0

Corrugator manning	
EWR 1	
EWR 2	1
Double backer glue unit	1
Supervisor	1
Delivery unit k1	1
Delivery unit k2	1
	5 Men/Shift

Manufacturing waste	7.0	Million m²/year	4.86	5.18
Net prod. million m²/year		Million m²/year	64.70	68.82
Net m²/h		ca.	17500	18600
Net prod. tons/year with 525 g/m²		ca.	34000	36130

Corrugators in the 80s



Two height-staggered automatic slitter scorers

the case of 2-shift operation the saving totalled approximately DM 100,000 (4000 h x 26.5 DM/h).

Adhesive cost savings. Approximately 2 g/m² adhesive savings through improved or new adhesive application systems yield a further cost reduction of approximately DM 100,000 per year.

Capital cost savings. If new units with 2.45 or 2.65 m working width are operated, because of the better deckling potential of wider units with only one or two paper deckles, roll stock levels can be drastically reduced. The resultant economies in capital costs exceed the increase in trim costs. Moreover, all the processes associated with paper—purchasing, stock control, handling and splicing—are considerably simplified.

Modernization measures, either implemented or planned further to the need to rationalize production, do not however, result in only a marked reduction in production costs but also to considerable growth of capacity. See Table 4.

So how can the small growth in consumption/demand (mentioned at the beginning) of approximately 2% for the '80s be reconciled with the greater degree of capacity growth of new or modernized corrugators?

Without doubt, outdated corrugators

The old folder/gluer
just ain't what it used to be . . .

Get your workhorse back in step with the

PACEMAKER RETROFIT SYSTEM

Specialty Equipment Corporation, an industry innovator for 23 years, introduces the Pacemaker Retrofit System to revitalize your existing S.E.C. Pacesetter or other RSC folder/gluer so you can keep up with the production demands of the 80's. And your competition.

Why spend hundreds of thousands of dollars for a new RSC folder/gluer when you can retrofit your existing machines for substantially less?

Don't let your older folder/gluer die. You can rebuild it economically, and increase its productivity. Save its life, and *your* money.

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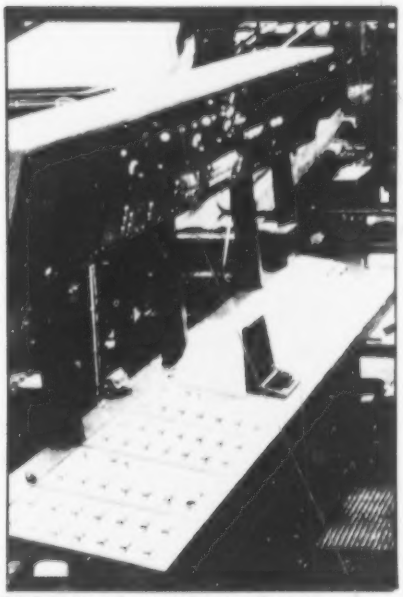
Corrugators in the 80s



BHS Teltrol Central Control Panel

must be reduced in numbers as also must be the number of shifts worked.

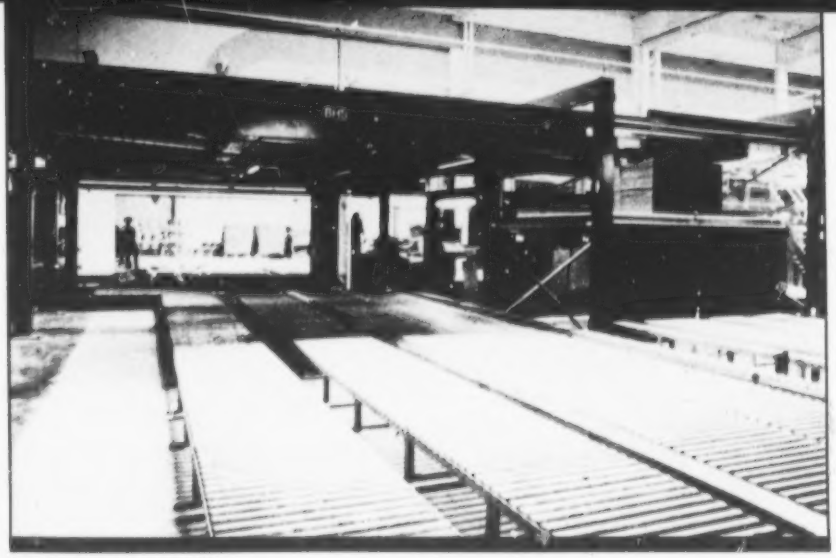
If, for instance, two old corrugators are replaced by one new modern facility, the latter is quite capable of at least equalling the workload of the two old ones and with much more favorable production costs.

Moreover, in the case of companies with two corrugators it makes sense to modernize only one. The additional capacity created can be used to cut the shifts on the first unit, while the second corrugator can be used more for the manufacture of specialized products.

Corrugated board factories with only one corrugator, which are not working to full capacity with two or three shifts, can, after a modernization investment program, deal with the existing volume but with the need for only one or two shifts. These measures result in further reductions in labor and energy costs.

The use of more sophisticated machinery imposes an increasing need for adequately trained and skilled personnel. Individual machine operators must therefore be given the appropriate training or else be replaced, through normal wastage, by machine fitters or electrical engineers who have been given extra training in the corrugated board manufacturing process.

If the high output of the modern corrugator cannot fully be covered by orders, there is the possibility of plant staff taking on the necessary maintenance of the machinery e.g. on Fridays. Expensive weekend overtime for this purpose can therefore, to a large extent be avoided.



Automatic stacker unit

Finally, factories with one corrugator working to capacity on a two shift operation, can make use of production time gained through automation and modernization to manufacture specialized products such as:

- corrugated board with laminated mediums;
- partly or fully impregnated corrugated board;
- heavy-duty corrugated board (heavy duty triple wall board);
- E-flute production;
- pre-printed liners, etc.

Mergers

The trend towards larger company units will continue. Product subdivision and product concentration can be more easily achieved by the larger concerns. Geographically close corrugated board factories can also pursue constructive investment policies by means of sensible co-operation. The small, but flexible, corrugated board company will always have its place on the corrugated board market, particularly if it specializes in special products.

Demand and capacity

By 1990 both the number of corrugators and the number of shifts will shrink, i.e. the outdated facilities with, generally speaking, too small working widths, will be cut back. The remaining approximately 90 corrugators, equipped with the latest machinery, will be able to handle the forecast growth in demand of approximately 15-20% with approximately 36,000 shifts per year. The average m^2/h output in 1980 of approximately 10,000-11,000 m^2/h will correspondingly rise to approximately 16,000-17,000 m^2/h.

In 1980 over capacity in West Germany came to approximately 10 - 15%, according to monthly market data.

In the '80s the capacity surplus must not exceed that for the last few years, once old, unproductive facilities are taken out of production and the number of shifts reduced.

Safeguards

The intensive efforts on the part of the corrugated board manufacturer in the field of product innovation must be strengthened yet further in order to offset the invasion of rival packaging products. The drastic increase in the price of crude oil products affords some hope for the future that some lost market can, in part or in total, be won back.

Staff training

The introduction of new machinery and systems, e.g. in the field of data-processing and microprocessor applications, in the corrugated board plant brings us to the need for better trained personnel, at all levels, in the corrugated board factory.

BHS is making great efforts to meet this need by means of outside training of operation personnel on new corrugators, as well as through on-site training.

Conclusion

On the basis of the above, we would like to answer the question posed by the title of this paper. The corrugator of the '80s ought to possess the following characteristics: It must display a high degree of automation to ensure cost-effective production and provide for the manufacture of specialized products with the help of additional machinery.

The pre-requisite for this—apart from management of the right caliber—is a personnel trained to an acceptable level of competence and a corrugator of the right design and engineering reliability. □